

Development of an orthopedic surgery trauma patient handover checklist

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Background: In surgery, preoperative handover of surgical trauma patients is a process that must be made as safe as possible. We sought to determine vital clinical information to be transferred between patient care teams and to develop a standardized handover checklist.

Methods: We conducted standardized small-group interviews about trauma patient handover. Based on this information, we created a questionnaire to gather perspectives from all Canadian Orthopaedic Association (COA) members about which topics they felt would be most important on a handover checklist. We analyzed the responses to develop a standardized handover checklist.

Results: Of the 1106 COA members, 247 responded to the questionnaire. The top 7 topics felt to be most important for achieving patient safety in the handover were comorbidities, diagnosis, readiness for the operating room, stability, associated injuries, history/mechanism of injury and outstanding issues. The expert recommendations were to have handover completed the same way every day, all appropriate radiographs available, adequate time, all appropriate laboratory work and more time to spend with patients with more severe illness.

Conclusion: Our main recommendations for safe handover are to use standardized checklists specific to the patient and site needs. We provide an example of a standardized checklist that should be used for preoperative handovers. To our knowledge, this is the first checklist for handover developed by a group of experts in orthopedic surgery, which is both manageable in length and simple to use.

Contexte : En chirurgie, le transfert préopératoire des polytraumatisés nécessitant une chirurgie est un processus que l'on doit rendre aussi sécuritaire que possible. Nous avons voulu déterminer quels renseignements cliniques vitaux doivent être transmis aux équipes de soins et préparer une liste de vérification standardisée à cette fin.

Méthodes : Nous avons réalisé des entrevues standardisées par petits groupes au sujet du transfert des polytraumatisés. À partir des renseignements recueillis, nous avons élaboré un questionnaire pour obtenir le point de vue de tous les membres de l'Association canadienne d'orthopédie (ACO) au sujet des éléments jugés les plus importants sur une liste de vérification en vue du transfert. Nous avons analysé les réponses pour dresser une liste de vérification standardisée.

Résultats : Sur les 1106 membres de l'ACO, 247 ont répondu au questionnaire. Les 7 éléments jugés les plus importants pour assurer la sécurité des patients lors du transfert ont été : comorbidités, diagnostic, état de préparation pour le bloc opératoire, stabilité, blessures connexes, histoire et mécanisme du traumatisme et questions en suspens. Les recommandations des experts ont été les suivantes : que les transferts s'effectuent de la même façon chaque jour, qu'on obtienne toutes les radiographies appropriées disponibles, qu'on dispose de temps suffisant, qu'on obtienne toute les analyses de laboratoire appropriées et qu'on aie plus de temps à consacrer aux patients plus grièvement blessés.

Conclusion : Nos principales recommandations pour un transfert sécuritaire sont d'utiliser des listes de vérification standardisées spécifiques aux besoins des patients et des sites. Nous fournissons un modèle type de liste de vérification pour les transferts qui devrait être utilisée pour le transfert en chirurgie des polytraumatisés. À notre connaissance, il s'agit de la première liste de vérification rapide et simple mise au point à cette fin par un groupe d'experts en chirurgie orthopédique.

Sir John Lilleyman, the Medical Director of the National Patient Safety Agency, stated, “Handover of care is one of the most perilous procedures in medicine.”¹ The risks to patient care associated with handover have been extensively studied among health care workers, including personnel from prehospital care, emergency department, nursing, intensive care unit (ICU), anesthesiology, general surgery, plastic surgery, neurosurgery and orthopedic surgery.^{2–12} Many groups have proposed handover checklists as a manner to improve information retention and handover safety.^{13–17}

Medical errors are common, occurring in 3.2%–10.6% of patients,^{18,19} and it is estimated that 58%–66% of these errors will result in patient injury.^{20,21} Up to 65% of these injuries are major, and up to 54% are preventable, with errors occurring more frequently in teaching institutions.^{18,20,21} About 18%–25% of these errors occur during the preoperative period.^{21,22} Although not specific to surgery, communication breakdown is a major factor in many cases of medical error.^{2,6,10,16,18,21,22} This lack of or miscommunication leads to cognitive overload, duplication of tests, missing data, medication errors, delayed diagnosis or treatment, increased length of stay in hospital (LOS) and poor patient care outcomes.^{23–26} Lack of information has been demonstrated in verbal handovers alone, whereas using both verbal and printed notes may result in the retention of up to 99% of the information.^{22,27} With decreased working hours and increasing amounts of handovers being performed daily, there is concern that an unstructured handover process will affect patient safety. Standardizing handover protocol for ICU, cardiac surgery and trauma patients has demonstrated reductions in verbal information omissions, loss of information, technical errors, postoperative complications and LOS.^{28–30} With standardized, high-quality handover of trauma patients, medical and surgical errors are reduced.

Previous handover checklists developed in surgery have not always included specific details about their development.^{5,9} The British Medical Association (BMA) has advocated that every hospital should have their own handover policy and specify who should be involved, when handover should take place, where it should occur and what needs to be handed over.¹ Therefore, the purpose of the present study was to identify and survey Canadian Orthopaedic Association (COA) members about the vital clinical information needed for the development of a standardized, preoperative handover checklist for use with trauma patients. The Conjoint Health Research Ethics Board at our institution approved our study protocol.

METHODS

To create the handover checklist, we first developed an online questionnaire following the standardized protocol for the design and development of a medical questionnaire

devised by Hales and colleagues.³¹ The initial step was to determine a need, which was the preoperative safety concerns during daily handover of the patients. We then identified the goal of (use during preoperative handover of trauma patients) and audience for (orthopedic attending surgeons and residents) the standardized handover checklist. Last, we established the content of the handover checklist based on 1) a comprehensive review of the literature; 2) expert opinions from local interviews of attending surgeons and senior residents in the design and development of a questionnaire; and 3) based on questionnaire responses, consensus among COA members about current practices and the vital clinical information needed for the development of a standardized handover checklist for use with orthopedic surgery trauma patients.

Three staff surgeons and senior residents participated in separate interviews using a standardized set of open-ended questions to gather their expert opinions on patient safety issues during the preoperative handover of trauma patients. The staff surgeons were from 3 different hospitals and had varying subspecialty training and years in practice; they also had a common interest in patient safety and handover practices. The senior residents were chosen for their interest in patient safety. Common themes and topics associated with patient safety were identified. This information was used to develop the questionnaire (see the Appendix, available at cma.ca/cjs).

This questionnaire content underwent face and content validity testing among orthopedic surgeons and residents and individuals outside the fields of medicine and surgery, who reviewed and modified the questions. The questionnaire was pretested multiple times to residents to evaluate its length and readability.

Once testing was completed, the questionnaire was developed using SurveyMonkey and was distributed by email to COA members. A cover letter was attached to the initial email, and a follow-up reminder with the same cover letter was sent 6 weeks later. The questionnaire was left open to responses for 8 weeks.

Response rates for surveys in general and for the orthopedic surgery community in particular are reported to be low (15%).³² In Canada, there are currently 1106 members of COA; therefore, we anticipated that at least 165 questionnaires would be completed by the residents, fellows and attending surgeons. We analyzed the questionnaire responses and calculated averages based on the responses. This information was then used to develop the checklist and provide information on how handover should occur.

Statistical analysis

General demographic information about the respondents included sex, level of training, completion of fellowship in trauma, experience in a level 1 trauma centre and location of current practice. Responses to questions were reported

using means and standard deviations or percentages. We conducted independent *t* tests and multiple 1-way analyses of variance (ANOVAs) to assess differences among groups, and we conducted paired *t* tests to assess differences within groups. We performed a post hoc analysis using a Tukey wholly significant difference test for variables that were found to be significant in our ANOVAs. We considered results to be significant at $p < 0.05$. When data did not adhere to the 3 basic assumptions of normal distribution, equal variance among groups and independent observations, then nonparametric testing was conducted using either a Mann–Whitney *U* test or a Kruskal–Wallis test, as indicated. With a known COA population of 1106 members, a 95% confidence level (CI) and a sampling error of 5%, we determined that a sample size of 285 respondents would be representative of the larger group.³³

RESULTS

All 1106 COA members (773 active attending orthopedic surgeons and 333 surgical residents and fellows) were emailed a link to the survey. In all, 194 attending surgeons and 101 trainees started completing the questionnaire (26.7%); 247 surveys were completed and returned for a response rate of 22.3%. Of those who completed the questionnaire, 21.5% were women, 16.2% had completed a trauma fellowship and 29.6% currently work in a level 1 trauma centre (Table 1).

Based on the Likert scale questionnaire, COA members felt that the 5 most important aspects of handover setup were

- having the handover occur the same way each day (overall mean 4.39 ± 0.69),
- having access to all appropriate radiographs at the time of handover (overall mean 4.37 ± 0.72),
- having adequate time for handover (overall mean 4.09 ± 0.70),
- having access to all appropriate laboratory work/patient information at the time of handover (overall mean 4.06 ± 0.88), and
- being able to spend more time with more severely ill patients (overall mean 4.05 ± 0.70).

Respondents felt it was important to have an educational component as part of handover (mean 3.46 ± 1.00), and that this education would improve patient safety (mean 3.52 ± 1.02). There were significant differences in responses between attending surgeons and trainees for the following factors: having the handover occur the same way each day (mean 4.30 ± 0.71 v. mean 4.55 ± 0.63 , $t_{266} = -2.943$, $p = 0.004$), having a dedicated room for handover (mean 3.77 ± 1.05 v. mean 4.07 ± 1.00 , $t_{266} = -2.332$, $p = 0.02$), ensuring there are no interruptions (mean 3.41 ± 0.88 v. mean 3.75 ± 0.82 , $t_{266} = -3.086$, $p = 0.002$), having adequate time for handover (mean 4.03 ± 0.70 v. mean 4.22 ± 0.68 , $t_{266} = -2.153$, $p = 0.032$), having the research coordinator present at handover (mean 2.49 ± 0.102 v. mean 2.86 ± 1.11 , $t_{266} = -2.755$, $p = 0.006$), handover occurring between incoming and outgoing attending surgeons and residents only (mean 3.12 ± 1.09 v. mean 2.26 ± 1.07 , $t_{266} = 6.201$, $p < 0.001$); handover occurring separately (i.e., attending to attending, resident to resident; mean 2.22 ± 0.90 v. mean 1.98 ± 0.91 , $t_{266} = 2.108$, $p = 0.036$), and handover occurring by telephone (mean 3.25 ± 0.99 v. mean 2.89 ± 0.95 , $t_{266} = 2.929$, $p = 0.004$).

The participants were asked through an open-ended question to identify the 5 most important issues to include in handovers to ensure high-quality patient safety. There were 1125 responses to this question, which we collected and grouped into common themes. The top 7 responses were: comorbidities ($n = 103$), diagnosis or injury ($n = 94$), history and mechanism of injury ($n = 90$), readiness for the operating room ($n = 89$), stability or current status of the patient ($n = 69$), associated injuries ($n = 61$), and outstanding issues ($n = 54$). The handover checklist was designed to address these responses (Fig. 1). Table 2 lists the information that participants considered to be vital information to deliver during handover; more than 70% of responses had scores between 4.0 and 5.0 on the Likert scale. No option was rated significantly more important than any other, therefore we added another column to the written checklist: “other pertinent information” (Fig. 1). There were some statistically significant differences in responses between attending surgeons and trainees for the following information: associated injuries (mean 4.56 ± 0.55 v. mean 4.41 ± 0.56 , $t_{249} = 2.041$, $p = 0.042$), substance abuse (mean 4.12 ± 0.63 v. mean 3.88 ± 0.72 , $t_{249} = 2.766$, $p = 0.006$),

Table 1. Participant level of training and place of practice

Characteristic	No. (%)
Training level/ time in practice	
Attending > 10 yr	86 (34.8)
Attending < 10 yr	71 (28.8)
Trauma fellow	4 (1.6)
Other fellow	18 (7.3)
Senior resident (PGY-4, -5)	38 (15.4)
Junior resident (PGY-2, -3)	22 (8.9)
PGY-1	8 (3.2)
Total	247 (100)
Province	
Alberta	54 (21.9)
British Columbia	40 (16.2)
Manitoba	8 (3.2)
New Brunswick	4 (1.6)
Newfoundland and Labrador	11 (4.5)
Nova Scotia	6 (2.4)
Ontario	73 (29.5)
Prince Edward Island	0 (0)
Quebec	35 (14.2)
Saskatchewan	16 (6.5)
Total	247 (100)

PGY = postgraduate year.

international normalized ratio (mean 4.58 ± 0.63 v. mean 4.42 ± 0.58 , $t_{249} = 2.009$, $p = 0.046$), complete blood count (mean 4.06 ± 0.85 v. mean 3.70 ± 0.85 , $t_{249} = 3.223$, $p = 0.001$), electrolytes (mean 3.96 ± 0.87 v. mean 3.51 ± 0.81 , $t_{249} = 3.989$, $p < 0.001$), and type and screen (mean 3.83 ± 0.92 v. mean 3.58 ± 0.87 , $t_{249} = 2.134$, $p = 0.034$).

Table 2. Participants' responses to the survey question, "What information do you believe is vital to provide during handover to obtain high-quality patient safety?"

Handover topic	Mean \pm SD*
Patient demographics	
Age of patient	4.20 \pm 0.63
Level of care (resuscitation level)	4.08 \pm 0.82
Where patient lives (i.e., house, condo, nursing home)	3.35 \pm 0.93
Injury	
Diagnosis/injury pattern	4.64 \pm 0.54
Mechanism of injury	4.20 \pm 0.70
Neurovascular exam	4.60 \pm 0.57
Open or closed injury	4.73 \pm 0.47
Polytrauma patient	4.70 \pm 0.50
Periarticular injury	4.35 \pm 0.70
Dislocated injury at any time	4.49 \pm 0.64
Reduced or not	4.69 \pm 0.49
Splinted or not	4.51 \pm 0.59
Pertinent physical exam findings	4.54 \pm 0.57
Unique fracture patterns	4.32 \pm 0.75
Preoperative considerations	
Urgency of OR (operation)	4.67 \pm 0.54
Current status of patient (i.e., stable or not)	4.72 \pm 0.48
Patient ready for operating room (i.e., medical readiness)	4.63 \pm 0.51
Reversible medical conditions/comorbidities	4.29 \pm 0.63
Recent pertinent medical conditions (i.e., MI, stroke, PE)	4.48 \pm 0.56
Need for anesthesia or internal medicine consult (and whether called/seen/cleared for operation)	4.54 \pm 0.55
Diagnostic imaging still needing to be ordered/reviewed (i.e., cervical spine for rheumatoid arthritis patient, CT scan for preoperative planning)	4.57 \pm 0.56
Associated Injuries	4.51 \pm 0.55
Patient factors	
Substance abuse (i.e., nicotine, ETOH, drugs)	4.03 \pm 0.67
Hand dominance	3.20 \pm 0.89
Functional status	3.77 \pm 0.85
Ambulatory status (i.e., preinjury use of walking aids)	3.89 \pm 0.81
Work status	3.37 \pm 0.86
Workers Compensation Board injury? (WCB, WSIB)	3.17 \pm 0.86
Prior pain/injury to current site of injury?	3.68 \pm 0.85
Blood work	
International normalized ratio (reversed or not)	4.53 \pm 0.62
Complete blood count	3.93 \pm 0.87
Electrolytes	3.80 \pm 0.87
Type and screen	3.74 \pm 0.91
Other	
Consent obtained (or need of 2 physician/interpreter)	4.43 \pm 0.63
Anything else preventing from taking patient to OR?	4.49 \pm 0.62
<small>CT = computed tomography; ETOH = ethanol; MI = myocardial infarction; PE = pulmonary embolism; OR = operating room; SD = standard deviation; WCB = Workers Compensation Board; WSIB = Workplace Safety and Insurance Board.</small>	
<small>*On a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).</small>	

The respondents answered Likert scale questions about the format they felt would best be used for a checklist. Both "written format" (mean 3.84 ± 0.94) and "placed in chart" (mean 3.78 ± 1.07) were rated significantly higher than "mental format" (mean 3.12 ± 1.05 ; $p < 0.001$). Responses from the questionnaire regarding current handover practices are shown in Figure 2. There were no significant differences in responses between attending surgeons and trainees regarding format of checklists or current handover practices.

DISCUSSION

Based on the responses of the 247 (22%) members of the COA who completed our survey on the handover of trauma patients, the details considered to be the most vital when handing over the care of the patients were diagnosis, associated injuries, comorbidities, readiness for the operating room, stability of the patient, history or mechanism of injury and outstanding issues. Based on these responses, we developed a checklist for use in trauma patient handover (Fig. 1). To our knowledge, this is the first checklist for handover developed by a group of experts in orthopedic surgery that is both manageable in length and simple to use. The topics covered on our checklist include those used in previously developed checklists, including diagnosis, comorbidities, history, mechanism of injury and outstanding injuries.^{5,7-9,12} It is important to remember that our checklist is not exclusive; it contains a column for "other pertinent information" to address the variability among patients who present with traumatic injuries. The checklist provides a starting point for information that should not be missed, but as seen in Table 2, most of the information has been deemed important by a panel of orthopedic surgeons and trainees across the country and any can be added at the discretion of the admitting physician.

Our survey was valuable for obtaining expert opinions on how handover should be performed. It has been previously suggested that handover should involve dedicated locations and access to laboratory values, radiographs and clinical information; occur in an open, friendly environment facilitating discussion and void of interruptions and distractions (e.g., phones/pagers); comprise 2-way communication involving feedback; have dictated leadership from a senior doctor; involve attendance by the entire team (may be multidisciplinary); and have an adequate, yet fixed duration.^{1,8,34,35} Our respondents agreed with many of these criteria. They considered it important that the handover procedure follow the same process each day, that all appropriate laboratory work and diagnostic imaging is available, that there is adequate time for the handover and that they could spend more time on the handovers of patients whose conditions are more severe.

Education as part of the handover process is rarely discussed in the literature and seldom indicates how this should be incorporated into the training program. Klaber and Macdougall³⁶ have discussed ideas of how a handover

process can be established within a pediatric setting. They suggested adequate planning, integration of learning into handover, keeping the education component interesting, using handovers regularly, ensuring handover training is meaningful and useful for trainees, and ensuring trainees and staff alike do not feel like it is just another chore to follow in

an otherwise busy day.³⁶ These steps could be transferred to an orthopedic surgery setting quite easily, especially in a teaching institution.

Checklists and standardized handover sheets have demonstrated improved retention of information between health care professionals.^{27,37,38} We proposed 3 different

M.D. C.H.A.O.S. checklist	Diagnosis and associated injuries	Other pertinent
ID: Name: Age: Place ID sticker here Sex: Location:	<input type="checkbox"/> Listed here (including severity/pattern) <input type="checkbox"/> Awaiting more information <input type="checkbox"/> Need to evaluate	
Mechanism of injury and history	Stability/Ready for OR	Instructions:
<input type="checkbox"/> List below <input type="checkbox"/> Need to evaluate	<input type="checkbox"/> Stable <input type="checkbox"/> Unstable (Location, why) <input type="checkbox"/> Ready for OR (consent signed, OR aware) <input type="checkbox"/> Not ready (WHY?) <input type="checkbox"/> Pending medicine/anesthesia clearance <input type="checkbox"/> Need to evaluate	
Comorbidities (pertinent/modifiable)	Outstanding (and who is following up)	<ul style="list-style-type: none"> • Each box must contain one checkmark minimum (check all that apply) • Please initial beside box if checked • Print this off for chart • Bring with you to handover in am
<input type="checkbox"/> Listed here <input type="checkbox"/> None <input type="checkbox"/> Need to evaluate	<input type="checkbox"/> Nothing <input type="checkbox"/> Labs <input type="checkbox"/> Diagnostic imaging <input type="checkbox"/> Consults <input type="checkbox"/> Other <input type="checkbox"/> Need to evaluate	

Fig. 1: Written checklist, including additional column "other pertinent information." OR = operating room.

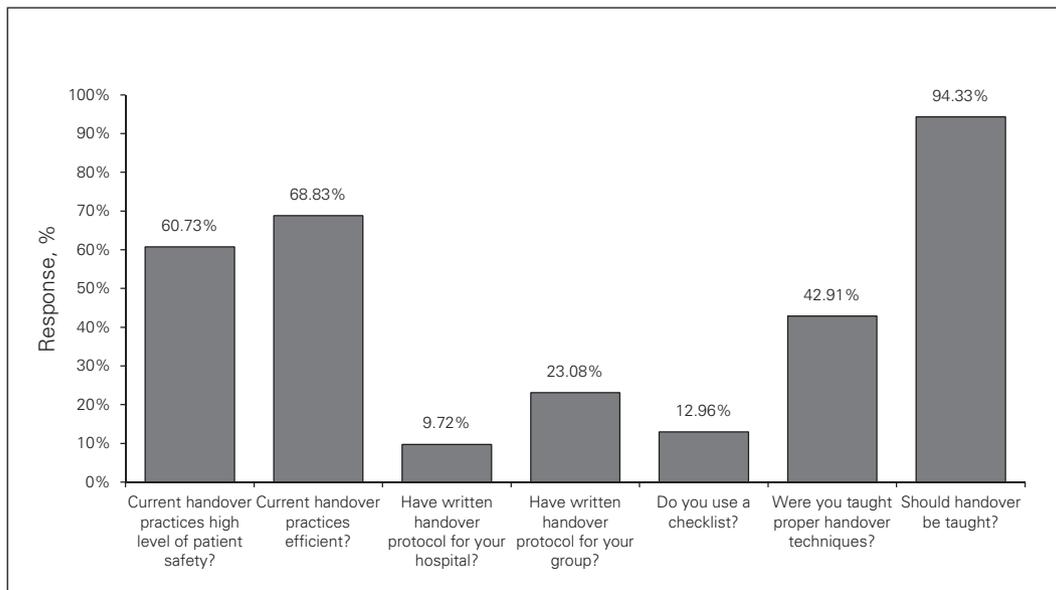


Fig. 2: Summary of questionnaire responses on current handover practices.

formats for handovers to the study participants, who felt that a written format or adding the checklist to a chart would be more valuable than mentally keeping track of these items. Our checklist should be brought to the handover and then kept in the patient's chart so that the relevant information can be available to anesthesiology and nursing staff when required. As charts shift to an electronic format, a digital format of our checklist could be used. The checklist should be an addition to current handover practices, not a substitute. The handover process itself, however, should be formalized on a group-to-group basis. A study in Northern Ireland demonstrated that 53% of surgeons had no handover policy and another 11% were unsure whether they did or not; 87% of surgical trainees had no guidance for handover, and 86% felt current handover practices were unsafe.³⁹ Our questionnaire demonstrated that most respondents felt their handovers were safe (61%) and efficient (69%). Similar to participants in the study by Kennedy and colleagues,³⁹ less than 15% of participants in our study reported having a hospital protocol for handover or using their own checklists, and only 22% said they had a handover protocol for their group. Approximately 41% of our respondents were taught handover techniques as trainees, and 94% felt that it was important to teach trainees the proper procedure for handover, which is supported in the literature.^{40,41} In regards to education, it is essential that trainees receive formal handover training, including presentation, communication, summarizing and questioning skills.

Limitations

Limitations of our study include the response rates for residents (27%) and attending surgeons (20%). To achieve a confidence interval of 95% with a 5% sampling error, responses were needed from 285 participants. Although 295 people started the questionnaire, only 247 (83.7%) completed it. The number of responses, however, did achieve a representative sample of active COA members with a confidence interval of 95%, plus or minus a 5.5% sampling error.³³ Other recent studies involving email surveys have reported response rates from orthopedic surgeons and trainees ranging from 11% to 34%.⁴²⁻⁴⁶

CONCLUSION

Nontechnical skills, such as handover skills, need to be perfected and appreciated by all medical staff. As stated by the BMA, handover is a process that must be continuously improved by all members of the health care team, as high-quality handovers do not happen simply by chance.¹ It has been encouraged that every hospital should have their own handover policy specifying who should be involved, when handovers should take place, where they should occur, and what information needs to be handed over.¹

Our respondents suggested ways on how handovers should take place and on what information should be included. Future studies will be used to validate this checklist, perform a sensitivity analysis and determine satisfaction with handover changes over time. To our knowledge, our study introduces the first preoperative surgical handover checklist guided by experts from the discipline and demonstrates how a standardized handover checklist can be developed. The handover of surgical trauma patients is an area that must be made as safe as possible. Our goal is that our handover checklist will provide a starting point for teams looking to perform safer handovers for all their patients.

Competing interests: None declared.

Contributors: J. LeBlanc, C. Hutchison and P. Duffy designed the study. J. LeBlanc and P. Duffy acquired the data. All authors analyzed the data, reviewed the article and approved its publication. J. LeBlanc wrote the article.

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